Department of FACILITY MAINTENANCE
Stormwater Workshop

POST CONSTRUCTION BMP
LESSONS LEARNED

June 26, 2017

Russell Leong
DFM – Storm Water Quality Branch
AGENDA

- THANK YOU
- PLANNING
- DESIGN
- CONSTRUCTION
- QUESTIONS
PLANNING LESSONS LEARNED

Post-Construction BMPs and Low Impact Development
UNDERSTAND SITE

• MICRO ENVIRONMENTS
  • SHADE – SUN
    • Saint Augustine; Bermuda
  • EXPOSURE TO BRACKISH WATER
    • Seashore Paspalum
  • HIGH TRAFFIC
    • Solid Turf over Seed
  • WINDWARD (wet) – LEEWARD (dry)
    • Soil Type
    • Plants tolerant of high moisture
    • Beach plants
UNDERSTAND SITE

KING TIDE: 5/25/2017 PEAK HIGH TIDE; PHOTO by ESH
UNDERSTAND CLIENT

• MAINTENANCE CAPABILITIES
  • NO ADDITIONAL MAINTENANCE STAFF
  • NO NEW EQUIPMENT
    • MOWER, WEED WACKER
    • BLOWER, RAKE
    • PRUNER
UNDERSTAND CLIENT
UNDERSTAND CLIENT
CHECK LIST ITEMS TO CONSIDER

 ✓ SITING
 ✓ PROVIDE PUBLIC AWARENESS SIGN
 ✓ PLANTS SELECTED FOR ENVIRONMENT. SHADE, SUN, BRACKISH WATER, HIGH GROUND WATER, CLOSENESS TO STREAM, LOW SPOT.
 ✓ SOLID TURF FOR HIGH TRAFFIC AREAS OR QUICK TURNOVER
 ✓ CLIENT MAINTENANCE ABILITY
DESIGN LESSONS LEARNED

Post-Construction BMPs and Low Impact Development
2016 Target Alameda, CA
Lessons Learned – EDUCATE

Protecting ocean waters with GRASS INFILTRATION AREAS

A GRASS INFILTRATION AREA is a type of LOW IMPACT DEVELOPMENT — a means to control storm water quality at its source, using methods to promote infiltration, retention, and treatment of pollutants.

At Kapolei Police Station, the City and County of Honolulu installed 250 lineal feet of grass infiltration areas. These rectangular areas are filled with amended soil. Storm water runoff with pollutants like oil, grease, toxins, and dirt from parking lot runoff can infiltrate into the amended soil and be retained onsite. This reduces the amount of pollutants leaving the site and going towards the ocean.

YOU can help to keep protect ocean waters too! Installing LIDs can be simple, let us show you how by visiting www.cleanwaterhonolulu.com
Lessons Learned – EDUCATE

Protecting Waters of Kalihi Using Low Impact Development

Kalihi Valley Watershed

The Kalihi Watershed is marked as the area surrounding Kalihi Stream, from the mountains to the ocean. Within this watershed are conservation, residential and industrial land uses. Kalihi Stream is impacted from polluted runoff coming from these lands.

What is Low Impact Development?

Low Impact Development (LID) are innovative practices that mimic nature to detain and filter storm water runoff. Examples of LID are rain gardens, bio-swales, rain water collection and green roofs. Installing LID at points where storm water runoff can be intercepted and filtered before reaching the storm water sewers helps to improve the water quality in receiving streams and the ocean.

How do these LID treat runoff?

- The first flush storm water runoff filters through a planted layer with amended soil. Pollutant removal includes filtration, adsorption to soil particles and biological uptake by plants.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Source</th>
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</thead>
<tbody>
<tr>
<td>Nutrients</td>
<td>Conservations lands, urban pollution and fertilizers</td>
</tr>
<tr>
<td>Nitrogen and</td>
<td></td>
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<tr>
<td>Phosphorus</td>
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<tr>
<td>Suspended solids</td>
<td>Erosion</td>
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<tr>
<td>Sediment</td>
<td></td>
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<tr>
<td>Erosion</td>
<td></td>
</tr>
<tr>
<td>Trash</td>
<td>Improper disposal of waste/litter</td>
</tr>
<tr>
<td>Bacteria</td>
<td>Pet and other waste products</td>
</tr>
<tr>
<td>Pesticides</td>
<td>Over application, historical practices</td>
</tr>
<tr>
<td>Metals</td>
<td>Tires, brake pads and roofs</td>
</tr>
</tbody>
</table>

STEAITH RAIN GARDEN at Kalihi Valley District Park

- A rain garden is a planted depressed section of land where rainwater runoff can collect and soak into the soil. They are good for slowing down runoff from impervious surfaces, filtering rainwater, replenishing our groundwater supply and ultimately decreasing the amount of pollutants that wash into our streams and oceans. This Stealth Rain Garden will use no plants and instead use Saint Augustine Grass and amended soil.

Visit www.cleanwaterhonolulu.com to learn how you can protect our waters.

BIO-RETENTION SWALE at Honolulu Police Department Kalihi Station

- Within the Kalihi Police Station parking lot, the city installed about 60 linear feet of bio-retention swale downstream of the parking area that is supplemented with a trench drain filter. Runoff is treated in the bio-swale before going into the storm drain. For small storm events runoff from pavement and associated pollutants are retained and infiltrated in the bio-retention swale.

Carex Grass

- The swale is landscaped with a sedge grass named Carex. It’s blades curve down, allowing it to slow the velocity of flowing water. Carex is great for landscaping because it doesn’t need to be cut as often as turf grass.
Lessons Learned – EDUCATE
Lessons Learned – EDUCATE DESIGN STAFF

Lessons Learned – PERVIOUS CONCRETE

PCC IN TRAVEL WAY
Lessons Learned – BIOINFILTRATION

KNOW YOUR EROSIVE VELOCITIES. ROCK AT CURB CUTS.
Lessons Learned – BIOINFILTRATION

CHIPS FLOAT. THERE IS A DIFFERENCE BETWEEN CHIPPING AND GRINDING
Lessons Learned – IT RAINS

SLOW WATER DOWN
MULCH TUBES
Lessons Learned –
IT RAINS

TEMPORARY EROSION CONTROL MATTING
IN LOW POINT
Lessons Learned – DRAIN INLETS

- Provide plastic screen without reduction in open area
- Keep leaves out of drain inlet to extend maintenance
Lessons Learned – VEGETATIVE SWALES

- Move drain inlet away from curb inlet
- Account for grass height
- Rock at curb inlet
CHECK LIST ITEMS TO CONSIDER

 ✓ ENERGY DISSIPATION AT CURB CUTS
 ✓ EROSION VELOCITIES OF AMENDED SOILS DURING CONSTRUCTION. IT RAINS DURING CONSTRUCTION!!
 ✓ BMPs TO SLOW WATER VELOCITIES
 ✓ EQUAL OPEN AREA SCREEN TO KEEP LEAVES OUT
 ✓ PUBLIC AWARENESS SIGN
CHECK LIST ITEMS TO CONSIDER

✓ USE SEPARATE SHEET TO IDENTIFY POST CONSTRUCTION BMPs

✓ SEDIMENTATION BASIN TO BIOINFILTRATION BASIN; DRAWINGS IDENTIFY RAKING; DRAWINGS PROHIBITING SCOOPING

✓ USE PROTECTION NOTES ON SHEET; CONSIDER INSTALLATION OF LID AFTER UPSTREAM VEGETATION IS IN PLACE; ELSE PROVIDE TEMPORARY BMPS TO PROTECT LID FEATURE
CHECK LIST ITEMS TO CONSIDER

✓ PHASE BIOINFILTRATION TILL AFTER LANDSCAPING

✓ SEDIMENTAION BASIN BOTTOM ELEVATION HIGHER THAN FINAL BIOINFILTRATION BOTTOM TO ALLOW RAKING AND REMOVAL OF SEDIMENT.

✓ RESTRICT CONSTRUCTION TRAFFIC AND ESPECIALLY LANDSCAPE TRAFFIC OVER PERMEABLE PAVEMENT

✓ NEXT PROJECT, CAN PERVIOUS CONCRETE HANDLE CONSTRUCTION VEHICLE LOADS?
CHECK LIST ITEMS TO CONSIDER

- EXTENDED MAINTENANCE PERIOD; DEFINE MINIMUMs (QUARTERLY, MONTHLY)
- PROTECTION OF EXIST LID ON DESIGN DWG
- REPLACEMENT OF PLANTS AND GRASS.
- O&M MANUAL; LOCATION OF LID
- INCORPORATE LESSONS LEARNED INTO COMPANY REVIEW CHECKLIST
Other LID Examples

2016 Target Alameda, CA
Other LID Examples

2016 Target Alameda, CA
Other LID Examples

2016 Target Alameda, CA
Other LID Examples

2016 Texas Road House, Fairfield, CA
Other LID Examples

2016 Texas Road House, Fairfield, CA
Other LID Examples

2016 Texas Road House, Fairfield, CA
Other LID Examples

2015 Othello Station, Seattle, WA
CONSTRUCTION
LESSONS LEARNED

Post-Construction BMPs and Low Impact Development
Lessons Learned – SUBGRADE

Figure 7. The rake method (A) for excavating the bottom of a bioretention cell creates less compaction than the scoop method (B).

Ref: Robert A. Brown, E.I.; William F. Hunt, P.E., Ph.D.; Urban Waterways, Improving Exfiltration from BMPs: Research and Recommendations, NC State University & A&T State University
Lessons Learned – TOP SOIL
Lessons Learned – DRAIN INLETS
Lessons Learned –
HIGH FLOW & VOLUME

Walmart, American Canyon, CA
Lessons Learned – CONCRETE

Turning Radius ??
Concrete instead of Grass?
Lessons Learned – CURB

Turning Radius ??
Curb??
Lessons Learned – RETROFIT

Top Soil Finish Elev ???
Maintenance ???
Speed Bump ???
Lessons Learned – CURB CUTS
CHECK LIST ITEMS TO CONSIDER

✓ PRECONSTRUCTION MEETING TO INCLUDE DISCUSSION LID CONSTRUCTION
✓ DISCUSS RAKING OF SUBGRADE
✓ DISCUSS IF WATER QUALITY BASIN IS RECEIVING WATER FROM LARGE DRAINAGE AREAS
✓ NO CONSTRUCTION EQUIPMENT OVER EXIST. PERVIOUS CONCRETE
CHECK LIST ITEMS TO CONSIDER

PLANNING
Incorporate Lessons Learned From Last Construction; Client

ISO 9001
ISO 15001

CONSTRUCTION
Capture Lessons Learned
Visit Site During Rain;
Store In Database

DESIGN
Incorporate Lessons Learned Pass; Pull From Data Base
QUESTIONS